II. AMENDMENTS TO THE SPECIFICATION

~~SPECIFICATION~~

TITLE

~~Vertical Vortex or~~ Laminar Flow Interactive or Vertical Vortex Biomedia Water Treatment Device

REFERENCE

Provisional Patent Application, Application Number 60/040,690; Filing Date 3/13/97; Docket Number W/C 367552

FIELD OF THE INVENTION

This invention pertains to a ~~A~~ process for treating water containing organic and/or inorganic matter. More particularly the invention discloses a process and apparatus ~~C~~consisting of inoculating an input flow with prescribed microorganisms or mixtures thereof in a chamber containing a media designed to effect separation through gravity and coalescence in flow induced vortices.

SUMMARY OF INVENTION

22

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Application No. 09/041,685

The invention is an apparatus and ~~A~~ a process, for treating water containing organic and/or inorganic matter, ~~C~~ consisting of inoculating an input flow with prescribed microorganisms or mixtures thereof in a chamber containing a media designed to effect separation through gravity and coalescence in flow induced vortices. The media additionally serves to provide hydromechanically enhanced substance retention and surface area, upon which, the introduced micro-organisms form a biofilm for the purpose of matter retention and/or decomposition. The media may be placed in a tangential or parallel orientation to the flow of input water.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other features and advantages of the present invention will become more readily appreciated as the same become better understood by reference to the following detailed description of the preferred embodiment of the invention when taken in conjunction with the accompanying drawings, wherein:

Figure 1. is a depiction of a reactive grease separation assembly comprised of a media matrix (1). The media matrix comprised of at least one inner core (70) received into a tube (20). The media matrix (1) depicted is comprised of a plurality of tubes (20) each receiving at least one inner core (70). Each tube (20) is sized to receive an elongated

22

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Application No. 09/041,685

media inner core (70. The inner core (70) having a plurality of vanes (90), and as depicted having eight vanes (90). The at least a plurality of vanes (90) extending from a central core element (95) where the central core element (95) coincides with the tube axis (25). The central core element (95) of at least one inner core (70) parallel with the central core element (95) of other at least one inner core (70).

The at least one inner core (70) has a top (75) and a bottom (80) and a length (85). The tube (20) having a tube top (25), tube bottom (30) and tube length (35) and tube (20) having a tube axis (37) centrally positioned from the tube top (25) to the tube bottom (30) and extending throughout the tube length (35) of each tube (20). The tube (20) in the preferred embodiment being cylindrical but not thereby limited to other geometric cross-sections and shapes. The tube length (35) generally less than the inner core length (85). As will be appreciated by one of ordinary skill in the art, the tube (20) receiving at least one inner core (70) may be positioned at any location along the inner core length (85), i.e., such that the tube top (25) is proximal the inner core top (75), such that the tube bottom (30) is proximal the inner core bottom (80) or such that the tube (20) is positioned intermediate the inner core top (75) and inner core bottom (80).

The tube (20) having an inner wall (140) where at least one depression or groove (150) is formed in the inner wall (140) which receives at least one vane (90), of the at least one inner core (70) received into the tube (20), at a vane tip (98) and, as

22

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Application No. 09/041,685

depicted, at least two vane tips (98) are received respectively into at least two grooves (150) formed in the inner wall (140).. The groove (150) comprising vane (90) restraining means securing the at least one inner core (70) in a fixed position within said tube (20). It will be appreciated by those of ordinary skill in the arts that the groove (150) may be a structure extending from the inner wall (140) forming a groove (150) which will receive at least one vane (90). Alternatively it is understood that the groove (150) may be a depression formed into the inner wall (140) capable of receiving the at least one vane (90). As will be appreciated by one of ordinary skill in these arts, vane (90) restraining means may be by a friction fit between the vane tip (98) when received into a groove (150) or by application of an adhesive or a mechanical fixing means between the vane tip (98) and the groove (150). In the preferred embodiment at least two depressions or grooves (150) are formed in the inner wall (140) with each of said grooves (150) receiving at least one vane (90). The at lease one vane having a vane surface (92). The at least one vane (90) extending from the central core element (25) along the length of said central core element (25). The surface (92) covered with a biofilm (97). In the preferred embodiment at least eight vanes (90) are spaced equidistant from the adjoining vane (90) and extending from the central core element (25).

The tube (20) having an outer wall (190) having at least one fin (200) extending outwardly therefrom. As depicted the tube (20) has at least four fins (200)

22

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Application No. 09/041,685

incomplete

extending from said outer wall (190). However, one of ordinary skill in the arts will appreciate that fins of (1...n may be employed in accordance with the space available and surface area desired. The fin (200) is generally elongated having a fin surface (210) and, in the preferred embodiment, extends outwardly from the tube outer wall (190). Where a plurality of tubes (20) are utilized the plurality of tubes (20) contact adjacent tubes (20) at the respective tube outer walls (190) at least one contact point (195) where, in the preferred embodiment, affixing means, including adhesives, mechanical fasteners and other methods or devices as are appreciated by those in the affixing arts, are utilized to fix adjacent tubes together and hence to fix the position of the plurality of tubes (20) within the media matrix (1). Tube at least one contact points (195) are, in the preferred embodiment, flattened surfaces extending from the tube top (25) to the tube bottom (30) parallel with the tube axis (37). In an alternative embodiment, tubes (20) in a media matrix (1) may be alternatively or additionally fixed in position by affixing means employed at an intersection of fins (200) of adjoining tubes (20).

The tube inner wall (140) having an inner wall surface (142), the tube outer wall (190) having an outer wall surface (192). Inner wall surface (142), outer wall surface (192), vane surface (92) and fin surface (210) receive biofilm (97).

Figure 2 is a top plan view of a media matrix

22

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Application No. 09/041,685

Figure 3 is a section view of an inner core showing a plurality of vanes.

Figure 4 is a section view of a tube showing an inner wall, an outer wall, at least one groove and at least one fin.

Figure 5 is a detail showing the tube (20) with a groove (150) which receives at least one vane (90).

Figure 5A is a detail from Figure 4 showing a fin (200) having a fin surface (210).

Figure 6 is a top view of a grease separator media matrix container (250). The top (290) is depicted. Wastewater inlet (350) and discharge pipes (400) are depicted.

Figure 7, 9 and 11 depict the grease separator media matrix container (250) in back view, section view and side view. Wastewater inlet and discharge pipes are depicted.

Figure 8 depicts the top.

Figure 10 is a detail from Figure 9 showing the discharge pipe (400).

22

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Application No. 09/041,685

Figure 11 is an end elevation of Figure 9.

DETAILED DESCRIPTION

An interactive biomedia or media matrix (1) constructed from plastic or other application suitable material with an eight vaned (92) inner structure means (90) comprising an inner core (70) having an inner core length (85) and a finned (200) cylindrical outer structure (20) comprising a tube (20) having a tube length (35), both of varying length, depending upon requirements, is placed in containments means (250) including grease separator media matrix containers (250) of varying configuration as required.

Fluid flow tangential to the vane structure induces vortices to form in the fluid. The low pressure area in the center of the vortices facilitates particle to particle collision coalescence and greater separation efficiency of suspended matter with buoyant material being retained in the upper cylindrical portion of the media and settleable material collecting at the base. Retained organic material can then be decomposed by biofilm formed on the surface of the media.

Figures 1, 2, 3, 4, 5, 5A, 6, 7, 8, 9, 10 and 11 is a depiction of a reactive grease separation assembly including a media matrix (1). The media matrix (1), seen in Figure

22

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Application No. 09/041,685

1, is comprised of at least one inner core (70) received into a tube (20). The media matrix (1) depicted is comprised of a plurality of tubes (20) each receiving at least one inner core (70). Each tube (20) is sized to receive an elongated media inner core (70. The inner core (70) having a plurality of vanes (90), and as depicted having eight vanes (90). The at least a plurality of vanes (90) extending from a central core element (95) where the central core element (95) coincides with the tube axis (25). The central core element (95) of at least one inner core (70) is generally parallel with the central core element (95) of other at least one inner core (70).

The at least one inner core (70) has a top (75) and a bottom (80) and a length (85). The tube (20) having a tube top (25), tube bottom (30) and tube length (35) and tube (20) having a tube axis (37) centrally positioned from the tube top (25) to the tube bottom (30) and extending throughout the tube length (35) of each tube (20). The tube (20) in the preferred embodiment being cylindrical but not thereby limited to other geometric cross-sections and shapes. The tube length (35) generally less than the inner core length (85). As will be appreciated by one of ordinary skill in the art, the tube (20) receiving at least one inner core (70) may be positioned at any location along the inner core length (85), i.e., such that the tube top (25) is proximal the inner core top (75), such that the tube bottom (30) is proximal the inner core bottom (80) or such that the tube (20) is positioned intermediate the inner core top (75) and inner core bottom (80).

22

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Application No. 09/041,685

The tube (20) having an inner wall (140) where at least one depression or groove (150) is formed in the inner wall (140) which receives at least one vane (90), of the at least one inner core (70) received into the tube (20), at a vane tip (98) and, as depicted, at least two vane tips (98) are received respectively into at least two grooves (150) formed in the inner wall (140).. The groove (150) comprising vane (90) restraining means securing the at least one inner core (70) in a fixed position within said tube (20). It will be appreciated by those of ordinary skill in the arts that the groove (150) may be a structure extending from the inner wall (140) forming a groove (150) which will receive at least one vane (90). Alternatively it is understood that the groove (150) may be a depression formed into the inner wall (140) capable of receiving the at least one vane (90). As will be appreciated by one of ordinary skill in these arts, vane (90) restraining means may be by a friction fit between the vane tip (98) when received into a groove (150) or by application of an adhesive or a mechanical fixing means between the vane tip (98) and the groove (150). In the preferred embodiment at least two depressions or grooves (150) are formed in the inner wall (140) with each of said grooves (150) receiving at least one vane (90). The at lease one vane having a vane surface (92). The at least one vane (90) extending from the central core element (25) along the length of said central core element (25). The surface (92) covered with a biofilm (97). In the preferred embodiment at least eight vanes (90) are spaced equidistant from the adjoining vane (90)

22

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Application No. 09/041,685

and extending from the central core element (25).

The tube (20) having an outer wall (190) having at least one fin (200) extending outwardly therefrom. As depicted the tube (20) has at least four fins (200) extending from said outer wall (190). However, one of ordinary skill in the arts will appreciate that fins of 1...n may be employed in accordance with the space available and surface area desired. The fin (200) is generally elongated having a fin surface (210) and, in the preferred embodiment, extends outwardly from the tube outer wall (190). Where a plurality of tubes (20) are utilized the plurality of tubes (20) contact adjacent tubes (20) at the respective tube outer walls (190) at at least one contact point (195) where, in the preferred embodiment, affixing means, including adhesives, mechanical fasteners and other methods or devices as are appreciated by those in the affixing arts, are utilized to fix adjacent tubes together and hence to fix the position of the plurality of tubes (20) within the media matrix (1). Tube at least one contact points (195) are, in the preferred embodiment, flattened surfaces extending from the tube top (25) to the tube bottom (30) parallel with the tube axis (37). In an alternative embodiment, tubes (20) in a media matrix (1) may be alternatively or additionally fixed in position by affixing means employed at an intersection of fins (200) of adjoining tubes (20).

The tube inner wall (140) having an inner wall surface (142), the tube outer wall (190) having an outer wall surface (192). Inner wall surface (142), outer wall surface

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Application No. 09/041,685

(192), vane surface (92) and fin surface (210) receive biofilm (97).

Figure 2 is a top plan view of a media matrix (1). Figure 3 is a section view of an inner core (90) showing a plurality of vanes (92). Figure 4 is a section view of a tube (20) showing an inner wall (140), an outer wall (190), at least one groove (150) and at least one fin (200). Figure 5 is a detail showing the tube (20) with a groove (150) which receives at least one vane (90). Figure 5A is a detail from Figure 4 showing a fin (200) having a fin surface (210). Figure 6 is a top view of a grease separator media matrix container (250). The top (290) is depicted. Wastewater inlet (350) and discharge pipes (400) are depicted. Figure 7, 9 and 11 depict the grease separator media matrix container (250) in back view, section view and side view. Wastewater inlet and discharge pipes are depicted.

22

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Application No. 09/041,685